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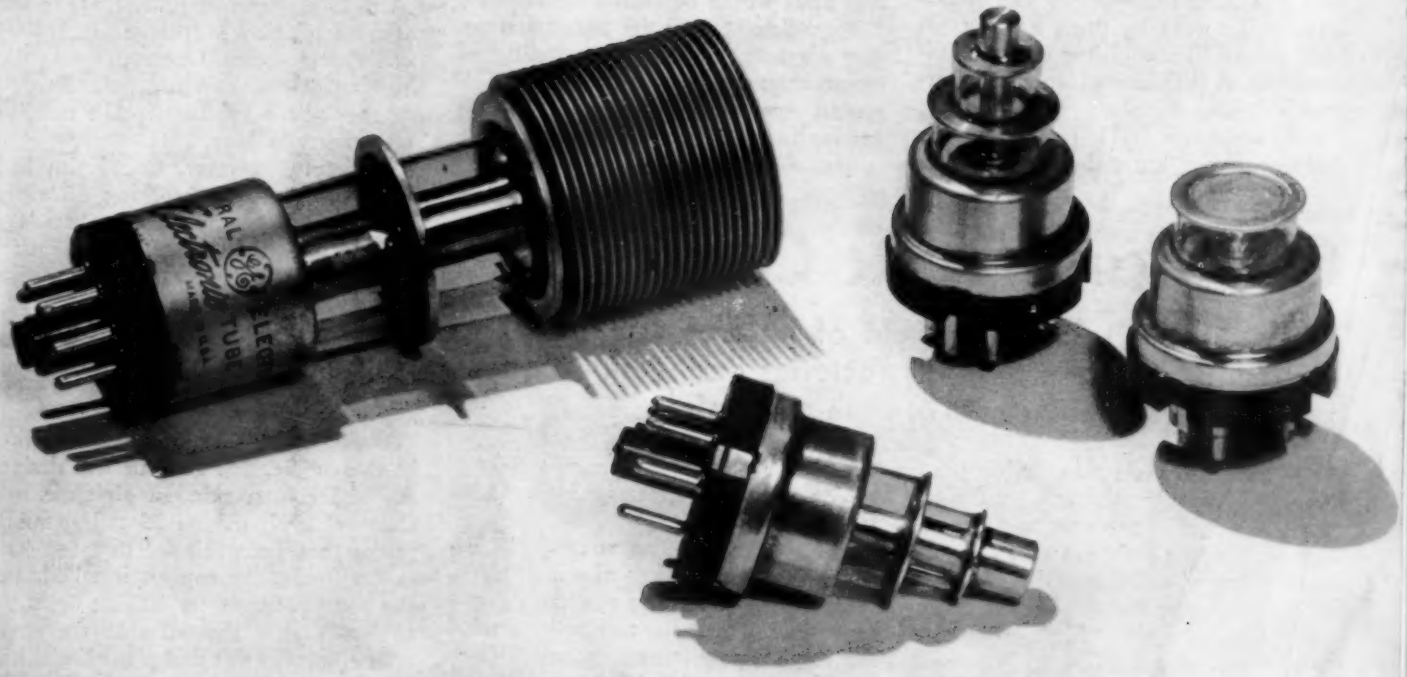
SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE • AUGUST 25, 1945



Mighty Midget

See Page 120

A SCIENCE SERVICE PUBLICATION

PUBLIC HEALTH

New Polio Weapon

DDT is sprayed from airplane on Rockford, Ill., as a possible aid in fighting an outbreak of disease in that city. May provide evidence of carrier.

➤ NEW development in the application of aviation to sanitation and public health is hinted in the use of a B-25 to spray DDT on Rockford, Ill., as a possible help in fighting an infantile paralysis outbreak in that city.

So far as infantile paralysis goes, this spraying of the potent insecticide by air and the use of DDT by power sprayers from an Army truck are in the nature of trial balloons. Dr. John R. Paul, of Yale University and some other scientists have for some years suspected that the common house fly might spread the infantile paralysis virus.

The virus of the disease has been found in flies, but whether the disease actually is spread by them has not yet been proved. Through the Army's Epidemiological Board and the Air Surgeon's Office, the plane from Wright Field and Army DDT power sprayers and men who know how to use the latter have been ordered to Rockford for the trial. The power sprayers will be used on fly breeding places on the ground, while the plane presumably will be used to distribute DDT where the power sprayers cannot reach.

If, at the same time or immediately after killing off all the flies in Rockford, cases of infantile paralysis drop sharply, it will be further evidence in support of the theory that flies spread this disease. The matter of timing will prove important, since the test would not be valid unless a full-blown outbreak was in progress and also would not be valid if the outbreak had progressed so far that cases would be falling off anyway.

Regardless of how the polio trials go, they seem to herald the beginning of rather extensive domestic use of DDT against flies and mosquitoes that endanger health or are a mere nuisance.

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AERONAUTICS

German Work Captured

Enemy research in field of jet-propulsion was revealed by surrender intact of factories and working drawings. Gas turbine and rocket both successful.

➤ GERMAN activities in building jet-propelled planes, particularly during the last 18 months of the war, and the details of these fighters, are no longer secrets, as many underground factories in which they were constructed were captured intact by the Allies. Plans and working drawings collected since VE day reveal that German scientists had long been interested in jet propulsion, both of the turbine-jet plane and the true rocket-propelled plane.

An experimental turbine-jet plane of German origin was flown in August, 1939, according to *Flight*, a British aviation journal. Its success led to further developments.

"The Germans were quick to recognize the possibility of speedy production offered by the simple gas turbine," the journal states, "and consequently, when they were forced on to the defensive by our bombing attacks, there was concentration upon jet fighters and reconnaissance types.

"The Germans also successfully developed a true rocket-propelled plane, the Me 163, which was extremely fast—faster indeed than the turbine-jet plane," the English publication continues. "This liquid rocket-propelled fighter which had a vertical fin only and no elevators—virtually a tailless type—was credited to Lippisch, who produced before the war a series of Delta machines of somewhat similar design but fitted with reciprocating engines."

German turbine-jet planes went into service on the Western front in the summer of 1944. At about the same time the British Gloster Meteor fighters with two Whittle-type jet units were coming into combat service. There is no record of jet-fighter meeting jet-fighter, but a number of German jet planes were shot down over the Western front.

Captured Heinkel-Hirth engines, used in some of the German jet planes, were regarded as unduly heavy and not outstandingly efficient, according to *Flight*: "Their 'overhaul' life is reported to be quite short—less than 25 hours—which contrasts with the 250 hours' overhaul life of a modern reciprocating type aircraft engine. Whereas turbines by comparison are more simple to service and maintain, the Germans do not appear to have taken advantage of this basic fact." They relied on replacements.

The British now have a jet-propelled plane, the de Havilland Vampire, capable of over 500 miles an hour. The American Army has recently revealed details on its new P-80 Shooting Star, which has a speed of over 550 miles an hour and is probably the fastest plane in existence.

America's active wartime interest in a jet-plane for fighting and other purposes may be said to date with the sending of an Army engineer, Col. Donald J. Keirn, to England in June, 1941, to get such information as possible on European developments. One result was the bringing of Frank Whittle, the English designer of the Whittle-type jet unit, to this country in May, 1942.

Previously, however, Col. Keirn had sent to Washington working drawings and information assembled by him. On Sept. 4, 1941, Bell Aircraft and General Electric engineers were asked to design and set up production of the Army's first jet plane. The first successful test run of the General Electric Whittle-type engine was in March, 1942. It was an improved model.

While General Electric was working on the engine, Bell Aircraft was designing and constructing an airframe. By October, 1942, the XP-59 twin-jet Airacomet had been shipped to a test base in California, the engines installed, and the plane prepared for its first flight.

Test flights showed that the small power units in this first plane limited its performance to that already obtained by conventional aircraft. General Electric set out to develop a larger and more powerful engine resulting in the power unit in the P-80. Earlier jet models have been relegated to the status of training craft.

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Shallow *cultivation* of the garden soil kills weeds that take both plant food and moisture needed by the vegetables; it also makes a dust mulch that lessens surface evaporation.

ELECTRONICS

Radar Secrets

Small tube used in instrument develops much more power than broadcast transmitters. Solutions of other research problems revealed.

➤ THE SMALL tube used in radar is the source of stupendous power. This tube may develop as much as hundreds of thousands of watts, as compared with the most powerful transmitter used for radio broadcast, which is limited to 50,000 watts.

The power must be applied in a burst for only a millionth of a second and then turned off completely to wait in repose for the echo to come back.

Development of this oscillator tube is termed a major achievement of the radar art by the official announcement issued by the Joint Board on Scientific Information Policy. The tubes used before the war at radar frequencies could develop only a few thousandths of a watt.

The receiver, which must be sensitive enough to pick up the tiny echo bounced off a distant ship or plane, must be protected against the terrific power burst of the transmitter, which would paralyze it or burn it out completely.

Transmitter and receiver are built in one box and operate on one antenna. This is really necessary because the directional antenna acts as a "searchlight" sending the signal out and as a "telescope" in picking up the echo. Naturally, both searchlight and telescope must be aimed in the same direction. This is sure when one antenna is used for both purposes.

But use of one antenna requires that the receiver be disconnected when the antenna is sending out the burst of power. The means for doing this was a particularly difficult piece of development, details of which are still not revealed.

Not only is it necessary to disconnect the receiver while the transmitter is working, but within a millionth of a second later the receiver must be open to receive the faint echo and the transmitter must be closed off so that it will not absorb any of the weak incoming energy.

To carry the energy from the radar transmitter to the antenna, ordinary wires and coaxial cables are unsatisfactory. For the microwaves used in radar, it is more efficient to use wave guides, which are really carefully proportioned hollow pipes known to radar men as "plumbing." For certain of the equipment these wave guides may look like rectangular rain-spouts. The high frequency currents from the transmitter are converted into electromagnetic radiation at the bottom of the pipe and guided through the pipe by successive reflections from the inside surface.

The problem of the antenna design was also a major one. It had to be highly directional. This can be done either by building it up of an array of small antennas, or by using the searchlight principle of spraying the energy into a large parabolic mirror which focusses the energy into a beam. In either case, the larger the antenna, the sharper the beam, but it can be made small enough to go on an airplane.

To use the radar to search the whole expanse of sea and sky, the antenna is turned, swung around or up and down to direct the beam in the various directions.

What the radar picks up is shown to the operator on a television-type screen. In the simplest type, an electrical mechanism causes a spot of light to trace a line across the screen at a uniform speed. The spot starts at one side at the instant the transmitter goes off. Whenever an echo comes in, the spot gives an upward bounce or "pip." The distance of this pip from the starting point gives the time required for the echo to return and therefore the distance of the ship or other target.

A target 1,000 yards from the radar will give a pip only six millionths of a second later than the transmitted pulse.

It is possible to set up the radar system to see all directions on one screen, with any ships and the shoreline appearing as in a map with the radar operator and his ship in the center. This is done by rotating the whole antenna system from one to 20 times a minute, scanning the whole horizon.

In this case, the dot of light starts from the center and moves outward in a direction corresponding to the direction of the antenna. Each echo, instead of making a pip, makes a bright spot of light, indicating both the direction and the distance of the ship that reflected it. The screen thus is an accurate map showing the positions of all the surrounding ships. The radar operator can, in fact, watch the shells move across the screen toward the target pip, and can even see the splashes they make when they hit the water.

An incident quoted in the official report tells of the commodore of a destroyer force who was watching the radar screen. It was a spectacular battle with blazing Japanese ships. (*Turn page*)

RADAR BOMBSIGHT—At the left is an ordinary air navigator's chart of Tampa Bay, Fla. At the right is the same "target" as seen on the radar bombsight screen. The straight lines across the water near the top of the picture are bridges and causeways. The small white dots show how boats and ships look to the radar eye. Notice how clearly land and water masses are distinguished.

"Come up here, for the sight of your life!" the captain called down to the commodore.

"No thanks," replied the commodore, "I can see better from here."

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MEDICINE

Water Spreads Hepatitis

First experimental evidence shows that the infectious liver disease is acquired in this way. Gamma globulin from blood gives protection.

➤ FOR apparently the first time, medical scientists have experimental evidence that infectious hepatitis spreads through contaminated drinking water. This is an inflammatory liver disease sometimes accompanied by jaundice which became widespread among both civilians and military forces during the war.

With this medical first comes also the first satisfactory evidence that a virus disease can be naturally acquired by humans through water.

Studies showing these facts are reported in the *Journal of the American Medical Association* (Aug. 11) by Capt. John R. Neefe, of the Army Medical Corps, and Dr. Joseph Stokes, Jr., of Philadelphia.

Gamma globulin from human blood, which is used to give protection against measles, will also protect against this infectious hepatitis, it was found in trials during an epidemic in a heavy bombardment group and various regiments of the ground forces in the Mediterranean Theater last winter. These trials are reported in the same issue of the medical journal by Dr. Stokes and Capt. Sydney S. Gellis, Maj. George M. Brother, Maj. William M. Hall, Col. Hugh R. Gilmore and Maj. Emil Beyer of the Army Medical Corps and Capt. Richard A. Morrissey of the Army Sanitary Corps.

Tests of gamma globulin as a protective against infectious hepatitis in the armed forces followed a test of the material by Dr. Stokes and Capt. Neefe during an outbreak of the disease in a camp for boys and girls last summer. The discovery that the virus causing the disease could be spread through contaminated water was made in further studies of this same epidemic. The water became contaminated through intestinal wastes from infected persons.

Chlorination of drinking water according to procedures commonly used for rapid disinfection under emergency conditions did not inactivate or weaken the virus, Dr. Stokes and Capt. Neefe found in studies made with Maj. James B. Baty, of the Army Sanitary Corps, and Dr. John G. Reinhold, principal biochemist of the Philadelphia General Hospital.

"Superchlorination" of infected water definitely reduced the ability of the virus to cause disease. Treatment of contaminated water with sodium carbonate and aluminum sulfate, used to remove extraneous material from drinking water by coagulation, and activated carbon, also used to remove materials from water, did not completely remove or inactivate the virus or germ of infectious hepatitis.

Methods used to disinfect water, the scientists report, may have to be modified further in order to inactivate completely the germ that causes infectious hepatitis.

Human volunteers had to be used for the studies, since there is no way of knowing whether the virus of the disease is present in a given material except by demonstrating the ability of that material to produce the disease in humans. Conscientious objectors and members of the Civilian Public Service Unit 140 of Philadelphia were among those volunteering for the studies. Besides drinking suspected and known to be infected water, these volunteers had blood serum, nose and throat washings and material from body wastes of patients given them, in order to learn how the germ spreads.

All the studies were carried out under the direction of the commission on measles and mumps of the Army Epidemiological Board.

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CHEMISTRY

Excelsior Planks for Your Postwar House

➤ THAT NEW house you are going to build now that the war is over may be made of excelsior instead of solid boards and planks sawed out of big logs. A process for making planks out of excelsior and Portland cement has been patented by Armin Elmendorf of Winnetka, Ill.

The excelsior, which may be made from such cheap, low-grade timber varieties as cottonwood or aspen, is first immersed successively in sodium silicate and calcium chloride. These chemicals react together to precipitate calcium siliate on the fibers; common salt, the other product of the reaction, is removed by washing. The excelsior is then mixed with a concrete slurry, molded to the desired dimensions, cured for a suitable period in a moist room, and set aside to dry.

Rights in Mr. Elmendorf's patent, No. 2,377,484, are assigned to the Celotex Corporation.

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ELECTRONICS

How Radar Saved England

It detected hostile warships from aircraft, warned of the approach of enemy aircraft, and defended harbors and coasts against small enemy vessels.

➤ HOW RADAR saved England from Hitler in the 1940 Battle of Britain and later from rocket bombs, the close cooperation of Great Britain and the United States in the development of radar even before Pearl Harbor, and the part played by radar in the air forces, on shipboard, and particularly in clearing the Atlantic of Nazi submarines, are revealed by the British Information Services.

The detection of hostile warships from aircraft, the warning of the approach of enemy aircraft, the defense of harbor and coasts against small enemy vessels, the feeding of gunnery data to predictors from "radiolocation," or radar equipment, the control of searchlights to illuminate aircraft targets, all these, the report states, were accomplished facts by the outbreak of the war in September, 1939. Outstanding improvements were, of course, made later.

The Battle of Britain, in 1940, was the turning point in the war, and it was the highly advanced system of coastal radar stations, begun in 1935, that made the victory possible, according to the report. These stations covered the east and south coasts of England. The Germans were unaware of their scope and accuracy. Nazi bombers taking off from France were watched by English radar throughout their entire flight no matter how roundabout their route. The advance information relative to the size of Nazi air squadrons and their routes is responsible for their defeat.

As the science of radar advanced, it was found possible to design complete stations so small that they could be fitted into an aircraft. They were at once installed in night fighters with such immediate success that within a few months the Luftwaffe was forced, in May, 1941, to discontinue the London blitz.

Before the Battle of Britain, the English Army and Navy, as well as the R.A.F., saw the importance of radar and set up research to find how it could be adapted to their particular needs. The Royal Navy began by using radar as an air-warning device but quickly found that as a method of range finding and gunlaying it was without a rival. Compact radar sets for gunfire control have been in British naval ships since 1940, and contributed greatly to their successes.

Robot bombs from the mainland coast directed on London were conquered largely by radar. "One of radar's most uncanny developments," the report declares, "a gun which aims itself and follows a moving target automatically and unerringly, was the climax, in 1944, of the British Army's research into radar applications.

"This British invention was incorporated into United States equipment, and quantities were manufactured and shipped to Britain, just in time to shoot down 80% of the flying bombs which were destroyed by anti-aircraft batteries."

A radar set called A.S.V. (air-to-surface vessel), which showed the presence of shipping, was installed in aircraft in 1939. Early in 1942 a version of A.S.V. was introduced which was capable of detecting surfaced submarines. This eventually robbed the commanders of these vessels of immunity from aerial attack at night when they were accustomed to surface. This equipment helped win the Battle of the Atlantic.

While the report claims for England the first operational system of radar to be installed in the world, that is, the detection towers installed along the coast, it gives credit to America for her independent development of radar, and particularly for her mass production of American, British, or cooperatively designed equipment.

In August, 1940, at the very moment when radar was proving its supreme value in the Battle of Britain, a small group of British scientists arrived secretly in Washington with complete plans of existing equipment and proposed equipment not yet fully developed. From that time on there has been a full interchange of information and research and the closest collaboration in development.

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***RADAR MANUFACTURE**—This is the way those super-secret radar factories looked. Here the equipment is being assembled in a General Electric plant for use in the U. S. Navy. Notice that the large tube which acts as electronic eye for the set is visible in side view in the set being handled by the worker at the left. The face of the tube shows in the set in the left foreground.*

PUBLIC HEALTH

Mortality in Childbirth Cut by One-Third

➤ THE CHANCE that a mother will live to enjoy the child she brought into the world is continually improving. The

mortality of women giving birth to children was cut by more than one-third in the United States during the first three years of this decade, areas with the worst records showing the greatest improvement. Only 20 white mothers per 10,000 live births died in 1943 and 51 colored mothers per 10,000 for the same year.

In 1940 maternal mortality in the white population ranged from a high of 39 per 10,000 live births in the East South Central states, to 27 in the Pacific states, census figures show. The difference between these rates was nearly halved by 1943, when the rate for the East South Central states was 25 per 10,000, while for the Pacific states it was only 18.

Closely associated with the unfavorable record for the East South Central states, point out statisticians of the Metropolitan Life Insurance Company, is the fact that only 43% of the confinements were attended by a physician in a hospital, a percentage smaller than for any other area. In the Pacific states, where the maternal mortality was lowest, 95% of the women gave birth to their babies in a hospital.

For the country as a whole, maternal mortality among the colored was fully 2½ times as high as that for the whites. Whereas 77% of the white births were hospitalized, only 33% of the colored were so cared for. In the East South Central states only 12% of the confinements were hospitalized, as few as 28% had the care of a physician in the home and 60% were attended by a midwife. In contrast to this, in the New England states 88% of the confinements among the colored were in hospitals and 12% had medical attention at home.

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PHYSICS

Atom No Longer Unknown

Only a half century ago, it was believed to be minute but solid "chunk" of matter. Complex structure gradually disclosed to physicists.

➤ IF THE atom has seemed a mysterious and theoretical commodity up to now, it is so no longer. It has landed in our thought, literally like a bomb-shell. What is this atom which the physicist splits, and how does he do it?

Until shortly before the year 1900 it was purely an academic question whether matter—a lump of coal or a quantity of air—could be divided and subdivided forever, or whether, eventually, a bit would be found so tiny that to divide it would be to destroy it, or at least to change it into something different. The mind prefers the first theory, for the imagination sees each of the halves of the divided piece looking much like the original. The boundary where this no longer holds true is outside the conditions of our experience.

But chemists, who had been studying the way substances combine, had long believed that they could explain the way combinations take place only by assuming units of each material. If water is always composed of twice as much hydrogen as oxygen, as they found to be true when they weighed the materials, then it seems obvious that, divided small enough, the ultimate drop of water will be reached. This ultimate drop the chemist calls the molecule. He believes it is composed of one atom of oxygen and two atoms of hydrogen. Divide it, and you no longer have water, but only the atoms composing it.

The indivisible atom was enough to explain chemical reactions. There was no need to inquire into its constitution until the turn of the century, when the discoveries of radioactivity and X-rays posed problems that could be answered only by supposing that the light that made the new chemicals shine and the radiations that fogged photographic plates must come from the structure of the atom itself.

The amazing new science of atomic physics grew out of the study of these new and unsuspected properties of matter. As one set of new properties was tagged as belonging to the nucleus of positive electricity which seems to hold the atom structure together, and another as due to the planetary electrons which can be pictured as circling around it, the image of the atom as a miniature solar system developed.

Studying the radioactive elements, radium, uranium, thorium and the similar short-lived ones that exist temporarily as their disintegration products, scientists found them to be giving off three different kinds of rays, which they named for the first three letters of the Greek alphabet. The alpha rays are composed of a stream of nuclei of helium atoms, the first recognized case of one element appearing as a disintegration product of another element. Alpha rays travel with such enormous energy, compared with their size, that they seem usable as a source of useful work. Beta rays are composed of electrons, not matter at all, but units of electricity. Gamma rays are like light waves and X-rays.

Since these rays given off by forces within the atom are among the very few materials in the universe comparable in size to the atom, physicists thought of using them as tools for experimenting with atom structure. In 1919 Sir Ernest Rutherford shot streams of helium nuclei, the alpha rays, through oxygen, nitrogen and other common gases and succeeded in getting some of the particles to collide with the central part of an occasional atom. While he could not see the particles, he could make them take their own pictures of the luminous trails they left behind them.

After the method of observing atom-trails had been worked out, physicists were able to use it and developments of it to learn what happens when atom "bombardment" is tried under various conditions, and how the number of "hits" can be increased. Ways to speed up the bombarding particles were learned. The greater the speed, the more hits there were recorded.

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ENGINEERING

Shipping Vegetables in Snow-Ice Keeps Freshness

➤ VEGETABLE produce shipped bedded down in finely granulated ice keeps its freshness, crispness, and vitamin C content over a longer period, researches conducted in 21 colleges throughout the country have shown.

"This method of refrigerating produce with snow-ice is like the protective effect of the late spring snows on vegetation," Charles F. Belshaw, research consultant of the National Association of Ice Industries, said, speaking as guest of Watson Davis, Science Service director, on the CBS program "Adventures in Science."

Researches show that vitamin C retention in foods is essential in the retention of flavor and that keeping vegetables fresh through use of snow-ice will bring food to the dinner table so that it tastes better and is nutritionally better.

Whole blood was shipped successfully across the Pacific in an insulated container in which the bottled blood is placed in racks around a large compartment of cracked ice, Mr. Belshaw said. Although temperatures inside planes in the Pacific often go as high as 130 degrees, this method keeps the blood to be used in treating the wounded at a temperature between 40 and 45 degrees which is necessary to keep it in usable condition.

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PHYSICS

Atom Force Due to Brisance

The suddenness of change from solid to gaseous state is responsible for the explosive force which makes the new atomic bomb the most terrible weapon yet devised.

➤ THE EXPLOSIVE force which makes the new atomic bomb the most terrible weapon man has yet devised for his own destruction comes from sudden release of energy. In most explosions energy makes itself known as heat and as shattering of nearby objects, caused by expansion of hot gases. This suddenness in release of power, known to explosives experts as brisance, depends largely on the speed with which the reaction takes place. Nitroglycerin has more brisance than gunpowder because it burns so much faster.

The new bomb is known to be powered with atomic energy. The feature of atomic energy which makes it a promising field for research is that, although the amounts of material available for use in the whole world are very minute, the amount of energy they can release is relatively enormous.

Conventional explosives are chemicals which burn very quickly, forming products which are wholly gases. These gases expand very fast in the heat their burning generates. They do not depend on air for their combustion. They carry in their own formulas the proper kinds and amounts of chemicals to form destructive masses of expanding gas, which push everything out of their way. They have to be mixtures which are relatively safe to handle, but which let go with a bang when set off by a detonator. The detonator supplies the margin of extra energy necessary to start the reaction.

Explosions due to sudden firing of small particles, like the dust and chaff in grain elevators, no less than those caused by explosives of the ammunition type, result in waves of hot gases. When confined in small space, these gases expand in every direction, and any part of their surroundings that can be moved is thrown or shattered violently by the blast. Dust is explosive because the large surface of its fine particles makes contact with plenty of oxygen in the air to burn it. Any chance spark can set it on fire.

Not all explosions result in release of energy. An overheated steam boiler explodes because the pressure of the gas inside has become greater than the walls of the boiler can support. The escaping steam becomes cooler, as contrasted with the hot combustion products of the dust and ammunition types. But whatever the cause, the shattering effect is capable of doing great damage.

Judging from the reports of the experimental explosion in New Mexico, both the brisance and the heat developed by the atomic power bomb are tremendous. If the steel tower which is reported to have disappeared is not found far away in the form of twisted scrap, or a melted puddle of iron at the site where it stood when the experiment started, it must be presumed to have vaporized. This would indicate temperatures hotter than 3,000 degrees Centigrade, or 5,400 degrees Fahrenheit. Astronomers are more familiar with temperatures in this range than are furnace men who work with molten earth materials. At even half that temperature, around the melting point of iron, life would vanish instantly in a puff of smoke.

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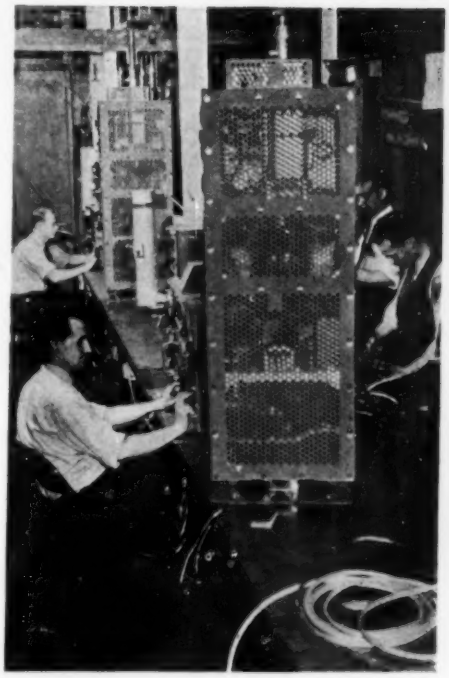
POPULATION

Small Town Girls Likely To Marry in Their Teens

➤ GIRLS living in small southern towns in the United States are most likely to marry before they are 20; those living in large northeastern cities are least likely to marry young.

One-ninth, or 11.1%, of the native white girls between the ages of 15 and 19 were married at the time of the 1940 census, the Metropolitan Life Insurance Company points out in its statistical bulletin. In the South, 18% of the young girls of the region were married before they were 20, and 20.6% of the girls in communities of less than 2,500 inhabitants.



TESTED—The radar transmitter set up for testing in a General Electric plant.

In the larger cities only 6.3% of the girls from the ages of 15 to 19 were married, while in the smaller towns and villages throughout the country 15.1% had been married. The farther west a young girl goes along the northern tier of the country, the better appear to be her chances for early marriage.

Although girls in our small towns and villages may have a better chance for early marriage than those in large cities, figures of the U. S. Bureau of the Census show that the probability of eventual marriage is greatest for those who remain on the farm.

Girls in the West have a better chance of eventual marriage than girls in other sections of the country, irrespective of whether they are living in cities or whether they have remained on the farm.

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Frogs croak mostly during the breeding season.

Metallic salts of *quinine,* added in tiny quantities to materials used in artificial teeth, give them fluorescence and make them glow under ultraviolet light similar to natural teeth.

PHYSICS-NAVIGATION

Electronic Navigator Is Adaptation of Radar

➤ AN ELECTRONIC NAVIGATOR for ocean, lake and river ships, that will detect by radar above-water obstacles such as other vessels, icebergs, land, lighthouses and buoys, is under test on shipboard by the U. S. Maritime Commission, it is now announced. It will detect these obstacles through darkness, fog and storm at distances up to 30 miles, depending on the size of the object.

The tests are being made on the SS American Mariner, training ship of the WSA's Maritime Service training program. Additional sets will be placed soon on other vessels. When materials are available the equipment will be obtainable by commercial shipping, both on inland waters and on the sea.

The device operates on the radar principle of radio waves which are reflected from objects and are measured to give true bearing and distances of the object from the point of sending. It has a rotating antenna, located on top deck of the vessel, sending out powerful radio micro-waves capable of penetrating fog or other atmospheric conditions. If these pulses hit an object, some of them are reflected back to the rotating antenna, which also contains a receiving antenna.

The apparatus is an adaptation of radar equipment that has served a valuable war purpose. The set under test was developed by the General Electric Company laboratories at Schenectady, N. Y.

Science News Letter, August 25, 1945

ENGINEERING

"Canning" Uranium Slugs Difficult Bomb Problem

➤ HOME CANNERS preserving the harvest of their Victory Gardens who may have an occasional failure don't know what real canning problems are. Learning how to "can" uranium slugs was one of the most difficult problems encountered in making atomic bombs, Dr. H. D. Smyth, of Princeton University and consultant on the project, relates in the technical report released by the War Department. The failure of a single "can" might have caused an entire operating unit to be shut down.

The most efficient way of cooling the uranium would have been to let the water flow in direct contact with the radioactive metal in which the heat was being produced. This seemed out of the question, however, since uranium would react chemically with the water. It was feared direct contact between the two would put a dangerous amount of radioactive material into solution and probably even disintegrate the uranium slugs.

No one who lived through the period of design and construction of the Hanford, Wash., plant is likely to forget the problem of sealing the uranium slugs in protective metal jackets, states Dr. Smyth. The state of the "canning problem" could be roughly estimated by the atmosphere of gloom or joy to be found around the laboratory.

A sheath had to be found that would protect uranium from water corrosion, keep fission products out of the water, transmit heat from the uranium to the water and not absorb too many neutrons.

Metal jackets or cans of thin aluminum were feasible from the nuclear point of view and were chosen early as the most likely solution of the problem, but alternative ideas continued to be explored. Both the problem of getting a uniform heat-conducting bond between the uranium and the surrounding aluminum, and that of effecting a gas-tight closure for the can proved troublesome.

Even up to a few weeks before it was time to load the uranium slugs into the pile there was no certainty that any of the processes under development would be satisfactory. A final minor but apparently important modification in the canning process was adopted in October, 1944, and up to the time of the report there had been no canning failures.

Science News Letter, August 25, 1945

INVENTION

New Milling Method Makes Aseptic Flour

➤ FROM an inventor in France, in preliberation days, came the application that eventuated in patent 2,379,677, on a milling method which the inventor, Voldemar Borsakovsky, claims will produce a flour so nearly free of bacterial life that its keeping qualities are better.

The wheat is first moistened, then tumbled in a rotor having abrasive inner walls, to "peel" off its indigestible cellulose outer coat. After the loosened bran and abrasive particles have been separated out, the grain is sterilized with a germ-killing gas, and finally milled in an atmosphere of a non-toxic gas.

Because rights in patents issued to citizens of formerly enemy-occupied countries have not yet been unscrambled, this patent is vested in the Alien Property Custodian.

Science News Letter, August 25, 1945

IN SCIENCE

ELECTRONICS

Lighthouse Tube Used To Make Radar Effective

See Front Cover

➤ THE FAMOUS lighthouse tube, known to engineers as a megatron tube, in which the grid, anode and cathode are of unconventional design (*See SNL*, August 19, 1944), was developed for use in radar, it is now revealed.

As frequencies in use became higher and wavelengths shorter, electronic tubes to produce the radio signals had to be smaller and the ability of the conventional type of tube to produce the necessary radio power became less. The new lighthouse tubes shown on the front cover of this SCIENCE NEWS LETTER are extremely compact and yet they have a high power output. The larger tube on the left is a transmitting tube; the others are receiving tubes.

Now that the war is over, it is anticipated that these tubes will be useful in television and FM systems as well as navigation aids.

Science News Letter, August 25, 1945

INVENTION

Separate Sterilizing For Cans and Contents

➤ SOMETHING new in canning methods for fruit and vegetable juices and other liquids is offered in patent 2,380,964, obtained by R. H. C. Mueller of Oak Park, Ill. In conventional canning practice, the cans are first filled and sealed, then placed in steam sterilizers for processing. This offers some disadvantages, especially when the juices are liable to injury by the prolonged high temperature necessary.

In Mr. Mueller's process, the cans are sealed empty, then cooled by passing quickly through a chilling bath, then conveyed to the filling machine. In the meantime, the juice or other liquid has been sterilized in bulk and is awaiting the cans in a reservoir, under a sterile atmosphere.

A hole is punched in the end of each can, the sterile liquid is forced in under pressure and the opening is quickly sealed while the can is still in the sterile atmosphere.

Science News Letter, August 25, 1945

CE FIELDS

CHEMISTRY

Permanents Achieved By Splitting Molecules

➤ THE TRANSFORMATION of straight, lank hair on a woman's head into soft curls and ringlets by the cold wave method of permanent waving turns out to be another triumph of modern chemistry.

Even the cracking of petroleum for the production of ethylene gas is involved, since substances synthesized from this may be used in the process. Details of the chemistry of cold waving are reported in *The Technology Review* (June), edited at the Massachusetts Institute of Technology.

Briefly, the cold wave method consists in applying chemicals which split certain protein molecules in hair. Among the chemicals that may be used at this stage are sodium sulfide, ammonium thioglycollate, and beta-hydroxyethylmercaptane, synthetic from ethylene gas. The unpleasant odors from these are camouflaged by perfumes.

The atoms of the split molecules are pulled into another pattern by the winding process familiar to those who give and get permanents. Then other chemicals are applied to recombine the atoms. Your hairdresser may refer to this last step as the "neutralizing" process. Chemically, it is an oxidizing process.

Science News Letter, August 25, 1945

PHYSICS

Defense Planned Against Radioactive Poison Gas

➤ DISCLOSURE of a hair-raising war danger now happily passed but which must have given a handful of scientists and top government officials many sleepless nights appears in technical information about the atomic bomb released by the War Department.

The possibility that the Nazis might make a surprise use of radioactive poisons in a "particularly vicious form of poison gas" was considered early in the American scientists' atom splitting experiments. Defensive measures were planned.

Radioactive poisons resulting from atom splitting were first mentioned in May, 1940, in a report of a National Academy of Sciences committee. They develop as the chain reaction of uranium splitting proceeds and have, in practice, turned out to be "the most troublesome feature of a reacting pile." They differ chemically from uranium, so it was believed it might be possible to extract them and use them "like a particularly vicious form of poison gas."

This idea was developed in a report written by Dr. E. Wigner and Dr. H. D. Smyth of Princeton University on Dec. 10, 1941, the day before we declared war on Germany. These scientists concluded that the fission, or atom-split, products "produced in one day's run of a 100,000 kilowatt chain-reacting pile might be sufficient to make a large area uninhabitable."

The use of these poisons was not recommended by the scientists, nor has it been seriously proposed since by the responsible authorities. The scientists and authorities, however, knew that the Germans were also racing to produce atomic power for military use.

"Serious consideration was given," the report states, "to the possibility that the Germans might make surprise use of radioactive poisons and defensive measures were planned."

Radioactive xenon, radioactive iodine and some 28 other chemical elements, all highly radioactive, are produced when uranium is split by fission. The safe disposal of these poisonous gases, so as to avoid endangering the territory surrounding the uranium-splitting plants, was a troublesome problem. The scientists were able to solve this as well as to plan for defense against possible use by the enemy of radioactive poisons produced by uranium fission.

Science News Letter, August 25, 1945

ENGINEERING

Glass-to-Steel Fusing Makes Airtight Seals

➤ GLASS-TO-STEEL fusing, to make a permanent airtight seal for metal electron tubes, is now possible through a method developed by engineers of the tube division of the Radio Corporation of America. It permits the use of a staple metal for the glass-to-metal seal in place of special alloys.

The new method depends upon the control of processing so as to secure good "wetting" of the steel by the glass. Also it incorporates a mechanical design which provides compression strains at the glass-metal boundary, thus compensating for the difference in expansion of the metals.

Science News Letter, August 25, 1945

RADIO

Television Broadcasting From the Sky to Be Tested

➤ TELEVISION broadcasting from stations in the sky six miles above the earth, in airplanes slowly cruising in circles, will be tested as soon as permits and equipment can be obtained, it is just announced by the Westinghouse Electric Corporation. Initial flight tests of the system, known as Westinghouse Stratovision, are expected to be made this fall.

The system would employ a low-powered ground transmitter to send television, and frequency modulation broadcast waves, to a specially designed high-altitude plane circling overhead. The plane would be equipped with receivers and transmitters for re-broadcasting the programs back to the earth.

The advantages to be gained by this television broadcasting from the stratosphere are wide coverage and relatively low cost over other systems proposed. Television and FM waves travel in a straight line and for all practical purposes, according to Walter Evans of Westinghouse, stop at the horizon. This means, he says, that television broadcasts from the highest practical tower erected on the ground cannot be received much more than 50 miles away.

"The Stratovision system," he explains, "simply puts the antenna and transmitter in an airplane flying in lazy circles 30,000 feet above the earth, out of sight of human eyes. The shortwaves sent out from this airborne antenna would blanket the earth's surface like a great inverted ice cream cone, covering an area 422 miles across or equal to the combined area of New York, Pennsylvania and New Jersey."

Eight such Stratovision planes properly positioned would give television and FM coverage from coast to coast.

"To provide comparable service by ground installations," Mr. Evans declares, "would require approximately 100 costly relay towers and hundreds of transmitters; or a coast-to-coast coaxial cable network which is estimated to cost at least $100,000,000."

The addition of six more planes in the right places would provide Stratovision coverage for 51% of the nation's area and 78% of its population.

A special slow-speed plane, almost as large as the B-29, has been designed for the stratovision system by the Glenn L. Martin Company of Baltimore.

Science News Letter, August 25, 1945

GENERAL SCIENCE

Critical Shortage

Wastage of scientific talent in making war has led to deficit of over 150,000 in training in science. National science scholarships urged to meet need.

By WATSON DAVIS

➤ THE greatest and most critical shortage in America, when viewed from a few years in the future, is the lack and wastage of scientific talent.

Science and technology in making war have been given the highest priority. Industry and government are making large and promising plans for the expansion of scientific research now that the war is over. Nevertheless, the young men who should be the scientists of the future have been inducted into the armed forces without any opportunity to contribute to the nation and the world their unusual and relatively rare abilities. By the thousands they are still in the armed forces doing non-scientific tasks.

Almost alone among the nations of the world, the United States has, through a series of expediencies and unhappy decisions in high places, left the scientific research abilities of the nation relatively unprotected from the ravages of war.

In England and in Russia, and even in Germany, young scientists were not allowed to join the fighting forces even if they wished to do so. They were set at tasks for which their abilities and training fitted them so that they could be best used in the war effort.

The recent report by Dr. Vannevar Bush, director of the Office of Scientific Research and Development, to the President stated:

Few Over 18

"Among the young men and women qualified to take up scientific work, since 1940 there have been few students over 18, except some in medicine and engineering in Army and Navy programs and a few 4-F's, who have followed an integrated scientific course of studies. Neither our allies nor, so far as we know, our enemies have done anything so radical as thus to suspend almost completely their educational activities in scientific pursuits during the war period."

In the United States the question of whether a young scientist in college, or working in a research laboratory, would be inducted into the armed service was left largely to the discretion of the local draft board. Draft boards, of course, have only limited information as to the needs, methods and urgencies of research. They are under the democratic pressure "that your boy is no better than my boy."

As a consequence, it is estimated by a careful inquiry of experts that the deficit of science and technology students who but for the war would have received bachelor's degrees, is about 150,000. And the deficit of those obtaining Ph.D. degrees in these fields will amount in 1955 to about 17,000. It takes at least six years from college entry to achieve a doctor's degree or its equivalent in science and engineering. This advanced training is quite necessary these days for those who are to explore the unknown and make the necessary developments out of which will come new cures for disease, new industries and better living conditions.

Only Part of the Story

These figures from the Bush report on our great endless frontier, which is science, tell only part of the story. These figures show only the great lack of scientific research personnel in order to keep our nation's scientific and technological resources at the level that they were before the war.

Now that the war is ended, truly tremendous research programs are being announced and discussed. One industrial operation alone is to spend $20,000,000 on a new research laboratory and expand manyfold its already extensive investigational facilities. The Bush report recommends federal research expenditures of $33,000,000 for the first year, rising to $122,500,000 at the end of five years, this expenditure to be in addition to the regular federal expenditures for research at a peacetime level.

Real need of scientists of the future is for this reason much greater than the estimates of deficits would indicate. For every scientist that worked before or during the war, two or three will be needed after the war. At least a quarter of a million young men and women should get back to college as fast as possible and begin studying these science and technical courses which they have been unable to pursue due to the interruption of the war.

This figure does not include the need for medical students to augment and maintain our supply of doctors in this country, nor does it include the related specialties of dentistry, pharmacy, veterinary medicine, etc.

Neither does it include the need of technically trained workers for control and development in industrial plants that make chemicals, metals, machinery and the other thousand and one things that are needed in the peacetime world.

One of the greatest blows to the continuance of scientific training by young men in the armed services was the placing in the infantry of approximately 100,000 Army specialized training corps men, about the middle of 1943. Up to that time the Army, as well as the Navy, had a college training program in many institutions throughout the country in order to provide the armed services with the technical and scientific personnel that was needed. This program was for all practical purposes wiped out in 1943 by the decision that placed all of these young men in the infantry, preparatory to the European invasion. Whether this sacrifice was needed to provide additional strength to the infantry will be a judgment of history. It is indisputable, however, that our scientific forces would, in all probability, be in much better condition now if this well-thought-out program had not been abandoned at that time.

There would have been some loss in scientific training even if the Army specialized training program had continued because the subjects taken in these college courses as arranged by the Army were oriented toward military service rather than toward basic scientific technological service. The Navy's various V-programs for officer training in colleges were not interrupted in this manner, and it is to be expected that a larger percentage of the young men in the Navy with potential scientific research abilities will eventually have a larger and earlier opportunity to enter into scientific research and development work.

To rescue the generation of young potential scientists now in uniform, the Army and the Navy are being urged by Dr. Bush and his committee to search out, discover and send back to college immediately those men who prior to or

during the war have given evidence of talent for science.

These scientifically talented young men, under this plan, would be ordered, by name, to duty in the United States as students for training in science and engineering of a grade and quality available to civilians in normal times.

The total number that would be selected on merit alone would probably be no more than a 100,000 which, under present conditions, would hardly have military significance.

But for building up the nation's scientific strength, that number would be very significant. These men would constitute the premium crop of future scientists.

Although these careful recommendations have been on the President's desk for several months and the Bush report itself has been public property for several weeks, so far as is known no steps are being taken to put into effect the suggested program or any modification of it.

Officials Insistent

High military officials are insistent that there be continued scientific research along military lines in order that our fighting forces in time of peace may maintain a supremacy which will either prevent war or give us the necessary fighting power in case we are again attacked. Scientific research is considered of major importance in Army and Navy plans for the future. By inaugurating this salvage of scientific talent within the ranks of the Army and Navy, those in command now can provide for future emergencies a national resource which cannot be purchased with dollars or any amount of sacrifice when the emergency arises.

Believing that soldiers in the service being discharged from the Army will need more college training than they will be able to get under the GI Bill of Rights, the report urges that in the case of those who are found to have marked scientific talent, the amount of education given under the GI Bill of Rights, should be dependent upon the ability to profit from the education rather than just length of service.

The 18-year-old boys who are being inducted into the armed services month by month still include those of great scientific promise who in England and Russia under the most severe conditions of the war would not have been allowed to enter the armed services. Instead, they would have been ordered to go into preparation for scientific research careers.

In the interest of our future military defense as well as our peacetime progress, the Army and the Navy might well take the initiative in keeping these few boys at their scientific studies rather than allow them to join the fighting forces.

How to provide for the constant renewal of our scientific talent is another major problem and a national program to that end has been suggested.

To insure through the long future an adequate supply of scientists and engineers for America, the recommended national science talent program would discover, train and maintain as a National Science Reserve some 6,000 potential scientists each year.

This "army" of young scientists would, after their training in various colleges on national scholarships, go into universities, laboratories, or industrial or governmental research organizations as they wish. But, in a national emergency they would be liable for call into federal service for scientific or technical work.

Under the plan suggested by the science talent committee headed by Dr. Henry Allen Moe and included in the Bush report on postwar scientific research, a total of 24,000 national science scholarships would be in college at any one time. There would be 900 fellows doing advanced work for the Ph.D. degree at any one time.

Selected from all parts of the country solely on the basis of merit, without regard to sex, color, race, creed or need, these potential scientists would receive scholarships patterned after the educational provision of the GI Bill of Rights. Tuition in any approved college would be paid up to $500 a year, and personal support of $50 a month if single and $75 a month if married would be provided.

When fully in operation the plan would cost $29,000,000 a year, a sort of insurance premium for the nation against stagnation in invention, scientific discovery, and industry, and an investment in national defense. One thing industrialists are sure of is that new products and methods must come from research if business is to be good. Military men are convinced that the weapons of any next war will not be those of this war, but will come out of research laboratories of the future, manned by the young scientists to be discovered and nurtured under this science talent plan.

This plan for a federally supported science talent search is no untried innovation in educational and scientific method. For the past four years, the Science Talent Search for the Westinghouse Science Scholarships has been conducted by Science Clubs of America as a Science Service activity. While the numbers and

Do You Know?

Some *bacteria* emit enough light to photograph objects.

Turkeys would be nearly extinct if they had not been domesticated.

The best pasture for *hogs* is alfalfa, experts claim.

North American Indians had no *beasts of burden* prior to the coming of white men.

Licorice has its characteristic taste due to the glucoside, glycyrrhizin, which is sweet in alkaline, but not in acid liquids.

Devil's shoestring, a wild American plant of the legume family, may be a source of rotenone for insecticides, according to studies in progress in Texas.

War-developed *walkie-talkies* are promised for reliable two-way communication between farms and town.

Butterflies that give off repulsive odors do so as a protection from birds and other enemies, and are found in both sexes; attractive scents are confined to the males.

Old rooster meat is tender and juicy if, six weeks before killing, a tiny pellet of synthetic chemical diethylstilbestrol was inserted under the skin through a small cut; it causes fat to form in the muscles.

A *cereal beverage,* recently patented as a coffee-substitute, is made from bran, poplar bark, molasses and vinegar; it has a coffee-like flavor, it is claimed, and acts upon the membranes of the throat in the manner of coffee.

amounts of scholarships granted under this program are much smaller each year, 300 of the most scientifically talented boys and girls in the nation have been located and, with the exception of the boys who were inducted in the armed services, most of them have been given opportunities for intensive scientific or technical study.

The Science Talent Search utilizes the newest psychological selection techniques, and combines a science aptitude test rating with searching evaluation of personal qualities and scholastic record. These methods of selections are proposed for use in the larger federal plan, which would use national examinations leading to selection by boards of judges in each of the states.

Although the first Science Talent Search was held at the beginning of America's entry into the war, some of the winners have already graduated from college and are doing research for advanced degrees, in some cases on military problems.

These Science Talent Searches for the past four years (the fifth one is being conducted this fall and every high school senior is eligible to compete) have shown that science talent may be found in the big cities, the small towns and the farms, in those whose parents are poor and in those with millionaire fathers or mothers, in those born here and those who came to our land as refugees.

Good science teaching in school from the first grade through the high school is needed to be sure that the scientifically talented do not go through the educational mill without their interest in science being awakened.

The intelligent reporting by American newspapers of scientific news is of major value in bringing the importance, method and possibilities of science to the attention of young people who possess scientific talent but who, except for the press, might never know of the opportunities and needs in this important field.

There exists in America the largest science organization in the world, the more than 150,000 members of Science Clubs of America, organized in some 7,500 clubs in the nation's high schools. From among these boys and girls who make science their serious hobby, many of America's scientists of the future will come.

How good a job they will be able to do in building us all a better future will depend in large measure on how thoroughly America searches for latent science talent and whether this search is supported with the necessary dollars and intelligent planning.

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CHEMISTRY

Transmutation Preferred

➤ TRANSMUTATION, for centuries the alchemists' goal, has suddenly become the laboratory method of choice of the group of scientists who worked out the chemistry of the atomic bomb. The account appears in the report, released by the War Department, written by Dr. H. D. Smyth, of Princeton University.

The problem was to separate two or more kinds of the rare metal uranium, which differ from each other in no discoverable way except that one is slightly heavier than the other. To separate them by this difference would have been a slow, tedious and unsatisfactory task, especially since the part that would be valuable for the project makes up less than one part in a hundred in any quantity of the ore.

Here the knowledge and skill of chemists who have studied the behavior of radium and other radioactive elements was put to good advantage. It has been found in work with such elements that their weight and their chemical nature depend on two kinds of minute particles which make up the hearts of their atoms.

The number of one kind of particle, the proton, in the atom heart is responsible for the nature of the element. One proton makes hydrogen, 26 protons make iron, 92 protons make uranium. The other kind of particle in the atom heart is the neutron. Uranium 235 has a net result of 92 protons and 143 neutrons, adding up to 235, according to the chemists' calculations, while uranium 238 has three more neutrons than its lighter isotope.

These two uraniums had to be separated, because only U235 would split up the way the scientists wanted it to for use in the atomic bomb. U238 would not. By lucky chance, the very property of U238 which made it useless for the purposes of the bomb provided the clue which solved the separation problem.

The more plentiful form of uranium, U238, could be made to undergo transformation into another kind of element

by first adding to the nucleus of its atom a neutron, to make it so heavy that it would become unstable, then by allowing this heaviest uranium atom to shoot an electron out of its structure. This loss of electrons from the total quantity of uranium showed itself as a phenomenon familiar to scientists as the beta ray. It is the peculiar nature of radioactive elements to change into something else when they emit beta rays, and that something else is, oddly enough, not a lighter but a heavier element.

Accordingly, when uranium 239, formerly the heaviest known element, emitted its beta ray it changed into a still heavier element, which the scientists working with the material named neptunium. Neptunium proved to be a rather unstable element, and emitted a beta ray in its turn. This change in the atom turned neptunium into another new element, which was named plutonium. The names of these three elements are taken from the three farthest planets of our solar systm.

Plutonium turned out to be a fairly stable element, about whose chemical properties enough was soon learned to prove that chemical separations of this new material from its parent uranium would be a relatively easy task. Plutonium does not readily follow the pattern by which it was formed, but makes the opposite transformation by which it gives off an alpha ray and turns back into uranium 235. This, however, happens so slowly that there is plenty of time for the atom-splitting reaction of plutonium to do its work.

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CHEMISTRY

Rubber Goods Produced In Tremendous Quantities

➤ SOME idea of the tremendous wartime production of rubber goods for the armed services may be gleaned from a report by the Rubber Manufacturers Association. Tires are but a single item. Equally essential, perhaps, are rubber boots for troops, battery cases, rubberized textiles, heels and soles for shoes, and rubber pads for tanks, aircraft and battleships.

More than 30,000 different rubber products were manufactured for war uses. Some were made from the limited supply of natural rubber, some entirely of synthetic rubber, and others of a combination of the two. The production program was hampered to some extent by the necessity of manufacturers and workmen learning how to use the new synthetic raw material.

Tens of millions of tires for land, air and amphibious vehicles have been produced since the beginning of the war, the report states. Over 45,000,000 pairs of rubber boots and shoes have been made, and some 10,000,000 hard rubber battery cases. More than 150,000 pounds of rubber compound is used in each new battleship. Over 360,000,000 yards of rubber-coated fabrics have been produced. Thousands of other rubber needs have been met.

Rubber industries had considerable natural rubber to use the first two years after Pearl Harbor, with some 600,000 tons of it on hand in December, 1941, and additional on boats on the sea. In three months the Japs controlled 90% of the world's sources of natural rubber. The first pound of synthetic rubber from the first plant in the joint government-industry program was produced on May 18, 1942. New synthetic rubber is being produced at a rate of over 700,000 tons a year. War needs have been met, and some rubber is available for the more essential civilian needs.

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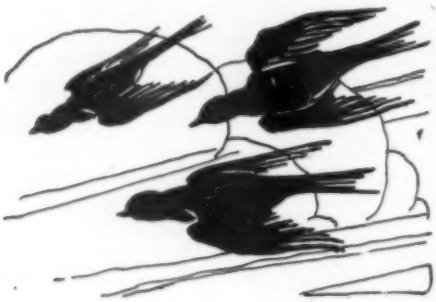
ORNITHOLOGY

NATURE RAMBLINGS

by Frank Thone



Ready to Fly

➤ MOURNFULLY melodious, the old song tells us:

"The swallows are making them ready to fly,
Wheeling out on a wintry sky."

Actually, swallows and a great many other birds "make them ready to fly" long before the sky becomes at all wintry. Those huge, twittering, circling flights of swifts and swallows at sunset on late summer days; the great, noisily talkative parliaments of blackbirds; the smaller, clubbier assemblies of many other bird species, are all parts of their pre-migration behavior patterns. They aren't starting south just yet, but they're "thinking about it." Some morning they'll be gone, though most of us are so little observant that we do not miss them until practically the whole summer bird population has slipped away.

So quiet is the migration of most smaller birds that it long remained one of the most mysterious phenomena of natural history. The ancient Greeks are said to have believed that swallows did not fly away at all, but buried themselves in the mud at the bottom of ponds, hibernating there with the frogs and turtles. Even in modern times, a great deal remains to be learned about these long seasonal flights.

One very curious effect on the winter bird populations of North America is produced by the triangular shape of the continent. Eastern and western species belonging to the same large groups but zoologically quite distinct are often funneled into the same close quarters in Central America and southern Mexico. Ornithologists making winter field trips to those regions often find birds in the same tree that in summer would not be closer together than Michigan and Oregon.

The question might arise, why do not these related species become hybridized? The answer, of course, is that in winter they are concerned only with feeding and keeping away from the cold, not with nesting and rearing young. In spring, they fly their several ways back to their widely separated breeding grounds. So the species remain distinct.

One of the outstanding riddles that still haunts ornithologists is how the birds learn their way south. Older birds, that have made the journey before, might be credited with remembering the route. But in most species, the young of the year start first, and they find their way to the winter feeding areas just as accurately as if they had experienced guides. That's something for students of bird behavior to work at for a while.

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CHEMISTRY

Processed Cream Kept Fresh, Tasty, for Year

➤ PROCESSED cream will be fresh and tasty after being kept at room temperature for a year or longer, thanks to a new method which sterilizes the cream. So far used exclusively in the production of processed table cream and whipping cream for the armed forces overseas, the new method recently announced results from six years of research by the California Milk Products Company, Gustine, Calif.

Only four minutes is needed to process the product, known as "Avoset." Instead of being pasteurized (unsuitable for such a process because it does not kill all bacteria) which requires that the cream be heated at 145 degrees Fahrenheit for 30 minutes, the mixture is preheated and sterilized at temperatures varying between 260 and 280 degrees Fahrenheit for about four minutes.

Prior to processing, a small amount of vegetable "stabilizer" is added to the sweet, fresh cream, to keep the milk solids in the finished product from separating out on long storage. After sterilization, the mixture is rapidly cooled and passed into a sterile holding tank, ready for bottling.

Air in the bottling and capping room is kept virtually free of dirt and bacteria by the Precipitron, an electrical air cleaner, developed by the Westinghouse Electric Corporation.

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Cacti found outside the Americas, Ceylon, Madagascar, and the Congo, have been taken there by man.

Because of its great weight confined in a small space, *lead* is used in factory lift trucks as a counterbalance to the load which is usually picked up and carried on racks or a platform in front of the truck.

Books of the Week

APPLIED MATHEMATICS FOR RADIO AND COMMUNICATION ENGINEERS—Carl E. Smith—*McGraw*, 336 p., illus., $3.50.

BONE-GRAFTING IN THE TREATMENT OF FRACTURES—J. R. Armstrong—*Williams & Wilkins*, 175 p., illus., $7. Foreword by R. Watson-Jones. A William Wood book.

THE ELECTROLYTIC CAPACITOR—Alexander M. Georgiev—*Murray Hill Books*, 191 p., illus., $3.

ELECTRONICS LABORATORY MANUAL—Ralph R. Wright—*McGraw*, 77 p., illus., $1. Laboratory textbook for students taking their first course in electronics.

LATIN AMERICA IN MAPS: Historic, Geographic and Economic—A. Curtis Wilgus—*Barnes & Noble*, 330 p., paper, illus., $1.25. College Outline Series.

METEOROLOGY FOR PILOTS—Robert W. Mudge—*McGraw*, 259 p., illus., $3.

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Science News Letter, August 25, 1945

ELECTRONICS

Safe Landings

Ground-control approach radar equipment will assist pilots through heavy overcast or in poor visibility. Can "talk-down" a blindfolded pilot.

By A. C. MONAHAN

➤ OF SPECIAL value for postwar commercial flying, to assist safe landings through heavy overcast or in poor visibility, is a ground-control approach radar equipment demonstrated before a group of science writers by technical men of the Army Air Forces. A blindfolded pilot, flying a gigantic plane, was "talked down" to the runway by a control operator while he was still several miles from the field and a thousand feet in the air. It was the most spectacular demonstration given to the group who had been assembled to learn about former radar secrets and Army specialized radar equipment.

All instructions to the pilot from the control were audible to the group by a special loudspeaker attached for the purpose. We watched the pilot turn to the right or to the left, or downward, immediately upon receiving instructions. He approached the landing strip at the proper end exactly at dead-center. When about ten feet from the surface, and ordered by the operator to take over, he removed the blindfold and made a perfect landing. The feat was a simulation of conditions encountered in landing through a heavy fog with a zero ceiling when the pilot cannot see the runway until the last moment.

The equipment is on the ground only. It links up with the radio-telephone equipment with which all military and most commercial aircraft are equipped. The operating crew of the control equipment "sees" by radar apparatus the plane in the air and the landing strip. The apparatus is as complex as any radar set in existence. The complete unit occupies two large trucks, one of which contains the air-conditioned operating unit and the other a power unit.

Tail Warning Set

A tail warning radar set, used most commonly in night fighters, lets a pilot, approaching a target or returning to his home station, know if he is being followed by another plane. It does not tell him if the trailing plane is friend or foe, but it does put him on his guard.

This tail warning device may serve a valuable purpose in civilian aviation in the coming days when commercial night-flying aircraft congest the airlanes.

Radar Altimeters

Low-range altimeters, for use within 400 feet of the earth, and high-range altimeters for altitudes between 400 and 4,000 feet, that measure the distance quite accurately between the plane and the surface under it, have also a distinct value in civilian flying. They are radar devices, depending in action on the time required for the high frequency wave to reach the earth and return to the instrument. They do not, like the barometer, indicate merely height above sea level.

Many of the military applications of radar which the Army Air Forces pioneered in combat were demonstrated or explained to the visiting group.

An unusually interesting piece of equipment, known as IFF, is originally of British design but is American made. IFF stands for "identification, friend or foe." Special equipment in a plane responds only when actuated by an interrogating set on the ground or in another plane. It responds automatically in the particular code set for the day. The pilot is unconscious of the waves from the interrogating set and also of the response sent out by the equipment on his plane. If an approaching plane fails to give an answer, and the right answer, it is regarded as a foe and immediately subjected to gunfire.

Science News Letter, August 25, 1945

•New Machines and Gadgets•

❁ *INFANT CARRIER is a canvas form, in which the baby is placed, suspended by a broad strap over the mother's shoulder. The baby sits upright, facing the mother, with his legs projecting through holes in the bottom of the canvas, and his head against her shoulder in the usual carrying position.*

Science News Letter, August 25, 1945

❁ *MACHINE running-time is recorded automatically by a new instrument for checking machine operation. It records on a chart both the "on" time and "off" time of production machinery and other similar equipment and also the time of day when these periods occur.*

Science News Letter, August 25, 1945

❁ *SYNTHETIC rubber pad, 116 inches long, 50 inches wide, and eight inches thick, is used in hydraulic presses to form heated magnesium sheets for airplane parts. When compressed, the pad transmits the full 5,000-ton pressure of the ram to the sheet, forcing the metal into the desired shape.*

Science News Letter, August 25, 1945

❁ *SPECIAL GAUGE, to measure the stack gases given off by new oil burners, give direct readings indicating the hazard involved. Transparent plastic cases over the vertical and horizontal scales, shown in the picture, help preserve them under corrosive conditions.*

Science News Letter, August 25, 1945

❁ *FLAME DETECTORS, placed at danger points inside the engine compartment in buses, flash red lights in front of the driver instantly on the outbreak of a fire. The driver then operates a fire handle near his seat and releases a flood of compressed carbon dioxide gas into the compartment, thus choking the fire.*

Science News Letter, August 25, 1945

❁ *PORTABLE electric heater has two sheet metal cylindrical upright housings, one centered within the other with air space between them, a gas-filled tungsten-filament radiant heat lamp, and a small electric fan to force air movement. The fan is at the bottom; the lamp is in the inner housing.*

Science News Letter, August 25, 1945

If you want more information on the new things described here, send a three-cent stamp to SCIENCE NEWS LETTER, 1719 N St., N. W., Washington 6, D. C., and ask for Gadget Bulletin 273.

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